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Eighth day of October 2004

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PROVISIONAL SPECIFICATION

for the invention entitled:

"Method and apparatus for testing air sampling systems"

The invention is described in the following statement:

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METHOD AND APPARATUS FOR TESTING AIR SAMPLING SYSTEMS

FIELD OF INVENTION

The present invention relates to a method and apparatus for testing the operation of air sampling pollution monitoring equipment. In particular, the present invention relates to a method and system for determining whether an aspirated smoke detection system is detecting smoke in a region adjacent a sampling point.. In one form, the invention relates to a device and a method of conducting field testing of aspirated smoke detection systems, and it will be convenient to hereinafter describe the invention in relation to that application. It should be appreciated, however, that the present invention is not limited to that application, only.

BACKGROUND OF INVENTION

Fire protection and suppressant systems may operate by detecting the presence of smoke and other airborne pollutants. Upon a threshold level of smoke being detected, an alarm may be activated and operation of a fire suppressant system may be initiated. While the fire itself will cause damage, considerable property damage and also environmental damage may also be caused by operation of the fire suppression system and subsequent removal of the suppressant may be quite hazardous. A detection system, which is sufficiently sensitive to detect an abnormal condition prior to the onset of a fire, is very advantageous as it enables action to be taken at a very early stage before the onset of actual fire conditions. For example, when most substances are heated, even before heating occurs to a point at which a fire commences, emissions will be generated and if these can be detected by a suitably sensitive system, a warning provided at that very early stage may allow the problem to be detected and rectified, or equipment turned off for example, before the fire actually starts.

Aspirated smoke detection systems may incorporate a sampling pipe network consisting of one or more sampling pipes with sampling holes installed at positions where smoke or pre-fire emissions may be collected. Air is drawn in through the sampling holes and along the pipe by means of an aspirator or fan and is directed through a detector at a remote location. Sampling points are located at regions where smoke detection is required. These regions are typically distant from the actual

detector. Although there are a number of different types of smoke detectors which may be used as the detector in a system as outlined above, one particularly suitable form of detector for use in such a system is an optical scatter detector, which is able to provide suitable sensitivity at reasonable cost. An example of such a device is a LaserPlus smoke detector as sold by the applicant. Optical scatter detectors operate on the principle that smoke particles or other airborne pollutants of small size, when introduced into a detection chamber and subjected to a high intensity light beam, will cause light to scatter. A light detector senses the scattered light. The greater the amount of smoke particles within the sample introduced into the detector chamber the greater will be the amount of light scatter. The scatter detector detects the amount of scattered light and hence is able to provide an output signal indicative of the amount of smoke particles or other pollutant particles within the sample flow.

A difficulty arises in operation of aspirated smoke detector systems of the above kind in that as the detector is remote from the sampling point, and the detector effectively detects smoke from a number of sampling points simultaneously, it is difficult to ascertain whether a sample point is effectively detecting smoke from a particular sampling point.

Smoke detectors which do not use aspirated sampling pipe networks are also susceptible failure; and are subject to other failure modes such as faulty electronic components. These detectors are commonly known as "point detectors" and often take the form of a detection chamber in a perforated housing located at the potential site of a fire. The housings are typically protected to some extent from the ingress of dust, lint and insects and the like by a filter which may comprise a fine mesh or other suitable barrier. These detectors rely on natural air movement for smoke to enter through the mesh, but they can become ineffective. Such point detectors are often tested in-situ when in operation in the field by enclosing them in a smoke-filled vessel holding a known concentration of smoke.

While this test method is appropriate for non-aspirated point detectors, it presents difficulties when applied to testing individual sampling points of aspirated detectors.

Any discussion of documents, devices, acts or knowledge in this specification is included to explain the context of the invention. It should not be taken as an admission that any of the material formed part of the prior art base or the common

general knowledge in the relevant art on or before the priority date of the invention disclosed herein or, any claims defined herein.

Disclosed herein is a method of field testing an aspirated smoke detector system sampling point, the method comprising the steps of:

connecting a flow sensing apparatus to a sampling point of an air sampling system,

measuring the air flow rate into the hole,

comparing the measured airflow with the airflow previously measured at the time of commissioning

determining from the comparative measurements whether the air-sampling hole requires maintenance.

In one form an extension is used to make the connection with the sample point from ground level.

In one embodiment the tube used to access the sampling from the ground level may be of an extensible telescopic type, fitted with an air-seal at the junction(s) of the parts to prevent leakage causing a mis-reading.

In another form, a sampling point testing apparatus for testing a sampling point of an aspirated smoke detector system is disclosed, comprising:

a first portion adapted to sealingly engage a sampling point of an aspirated smoke detector;

a second portion comprising an air flow sensor operatively connected to an air flow data storage;

a third portion providing sealed fluid communication between the first and second portion such that air flows from the second portion into the sampling point via the first portion.

Preferably the second portion of the apparatus further comprises comparator means for comparing a measurement of the air flow sensor with a pre-recorded air flow measurement of the sampling point stored in the air flow data storage.

In one form the air flow sensor is an ultrasonic sensor.

In one form the apparatus has an articulated connection intermediate the first and third portions for providing relative movement between the first and third portions.

Preferably the articulated connection is a flexible collar.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic representation of a first embodiment of an aspirated smoke detection system

Figure 2 is a schematic representation of a second embodiment of an aspirated smoke detection system

Figure 3 shows a first embodiment of an air sampling apparatus.

Figure 4 shows a part of an air sampling apparatus of figure 3 with a sample pipe;

Figures 5a and 5b show a cross section of the air sampling apparatus with a sampling pipe

Figure 6 shows a portion of a second embodiment of an air sampling apparatus with a sampling point of a sampling pipe.

DESCRIPTION OF PREFERRED EMBODIMENT

An aspirated smoke detection system 10 is shown in figure 1, and comprises a pipe 12 having a number of sampling points 14, and a detector 16. The detector may be any type of smoke detector, including for example a particle counting type system such as a LaserPlus sold by the applicant. Typically the detector 16 includes a detection chamber, indicator means and an aspirator for drawing sampled air through the pipe into the detection chamber. In operation, each sample point will be placed in a location where smoke detection is required. In this way a sampling point acts to detect smoke in a region.

A second embodiment of a smoke detection system is shown in figure 2, where a pipe network 20 comprising a number of pipes 22 with sampling points 24 is shown. A similar detector to the detector 16 shown in figure 1 may be used. One pipe 22 may consist of a branch, such as branch A in figure 2.

In the above systems, air is drawn through sample points 14, 24 and into the pipe 12, 22. The pipe 12 (or 24), will have a number of sampling points 14, (or 24), and therefore air will be drawn through all sampling points within a single pipe when the sampling points are open. Typically during installation all holes are open. If all sampling points are of equal resistance to flow, there are no flow losses along the

pipe, and the ambient pressure outside each sample point 14 is the same, then the airflow through all sampling points along pipe 12 will be equal. This results in equal dilution of air from each region to be sampled. Thus, fro example, if an alarm is to be sounded if smoke of more than 1% obscuration is present in a sample region, then the detector will have to sound an alarm at 0.1% to accommodate the dilution factor of 10 holes for the system as a whole. However, it is known that in some circumstances, one or more sampling points may block. Typically, ascertaining whether smoke will be detected in a region has been undertaken by placing the detector (such as a point detector) in an enclosure, wherein the enclosure has a known smoke level. If the detector sounds the alarm then the detector is considered operational. Another method is to direct smoke towards the detector to attempt to provoke an alarm.

However, the above methods are problematic when dealing with aspirated smoke detectors. In a sampling system as described above and shown in figures 1 and 2, the alarm will be raised remotely at the detector, rather than in the region where testing is conducted. Further, producing smoke accurately in a number of different areas to test multiple sampling points is difficult, and results can therefore be difficult to analyse.

It has been discovered that it is not necessary to put smoke into each sampling point to ensure that the smoke will be detected in that region. It is only necessary to detect the flow rate through the sampling point to ascertain whether the sampled air will be drawn into the detection chamber. For example, if there is no flow through a sample point then the region is not protected. Further, if the flow is too low, then the air from that point will be excessively diluted and smoke detection within the desired levels will not be achieved. Additionally, if flow along a pipe is too low, then transit time for the smoke will exceed requirements.

It has been discovered that a suitable method for determining whether a region is adequately serviced by an aspirated smoke detection system is to:

Detect the flow rates through each sample point at a first time (for example after installation, cleaning or repair);

Detect the flow rates of air through at least some sampling points at some later time (annually, after an incident or some other period);

Compare the flow rates to ascertain whether there has been a significant difference.

In determining whether a significant difference has occurred, the transit time and dilution factors may be taken into account. For example, if the dilution of the air through one sampling point is such that it would not be possible to detect smoke in the region at the requires level, or the other sampling points became too sensitive, then the sampling point or pipe may require cleaning.

Optionally, a system such as the Aspire computer program may be used to determine whether the new flow rates produce an acceptable result. Aspire is a program that models air flow in an aspirated smoke detector pipe network.

To determine whether the detector is working it is only necessary to admit smoke into the system at one point. If this smoke is detected, then the detector is clearly working. A single release of smoke is easier to control, and typically may be done at the last sampling point on a pipe, where the last sample point is defined as being furthest from the detector.

In figure 3 a first embodiment of an air sampling apparatus 30 is shown. Air sampling apparatus 30 includes a flow meter 32, a connector 34 and an extension 36. The connector 34 is adapted to fit over a sampling pipe 38 of a sample point (best shown in figures 4, 5a, 5b and 6). The connector 34 may take a number of forms depending on the type of sampling point used in the aspirated system. Some forms of sampling point are shown in figures 4, 5a, 5b and 6, but the apparatus may be used with a variety of sampling point configurations. The main feature of a connector 34 is that it is adapted to fit a sampling point in a way that provides a reasonable seal. Perfect sealing, while desirable is not required, given the relatively low pressure differentials anticipated in measuring air flow through the sampling points. Sampling points typically have holes from about 2mm and larger in diameter. Hole 37 represents one form of sample point, while sampling point 38 represents another.

Once the connector 34 is over the sampling point, a flow reading can be made. If the sampling point is not blocked, and the aspirator is operational, some air will be drawn through the sample hole. The flow meter may take a number of forms, but in the present embodiment an ultrasonic flow meter is used. The ultrasonic flow meter consists of two transducers spaced apart by a known distance, exposed to but not necessarily in the air flow into the sampling point. The flow is detected by measuring time of flight of the ultrasound from one transducer from another, in a known manner. The use of ultrasonic transducers allows for accurate measurement of airflow, while providing low resistance to air flow, as the transducers do not need to project into the

airstream. The flow meter outputs a reading, for example in litres of air per minute, to the user, and /or stores the reading in a memory device (not shown). This data may then be correlated to data collected from previous tests.

If a sampling point is blocked, it maybe cleaned by known instruments such as a pipe cleaner.

It is also possible to detect airflow down a branch of a pipe network (such as branch A in figure 2), by detecting airflow through the sample holes 24 in that branch. This method is useful for determining whether the pipe may have leaks, blockages not related to a single sampling point, or other external issues such as variations in ambient pressure between branches.

Flow impedance of the extension 36 and the apparatus 30 in general must be sufficiently low to have a negligible effect on the flow being measured through the sample point. Preferably the apparatus 30 should be hand-held, light weight, and powered by internal batteries. Typical flow rates in a sampling point are in the region of 2 litres per minute; but this may vary. The preferred flow reading accuracy should be approximately 0.1 litres per minute or 10% of reading, whichever is the greater. Pressure drops across the sampling hole may be as low as 25 Pascals so the tube and sensor should ideally not produce a combined pressure drop of, for example, more than 2.5 Pascals. As an example a tube inner diameter of 21mm for the extension 34 will ensure a suitably low pressure loss at a flow rate of 2 litre/min in a tube of up to 6m length.

To ensure a low-leakage air seal to the sampling point the end of the tube may be fitted with a suitably shaped soft seal; eg made of rubber, neoprene or the like. Examples are shown in figures 4-6. Typically there are 2 commonly used style of sampling points in aspirated smoke detectors, also shown in figures 4-6.

The first type of sample point 37 is a simple hole drilled in pipe 38. Typically the hole 37 may be of 3mm diameter, while a pipe 38 may be of 25mm outer diameter; though these figures will vary from design-to-design and from region-to-region. To accommodate this the connector 34 of the pipe 38 may be fitted with a pick-up head of a trough-like shape, U-shaped in cross section, with a seal around the rim.

The second style of sampling point is typically in the form of a nozzle 39 connected to the sample pipe 38 by a length of relatively narrow flexible hose 41. Referring to FIGURE 6, to accommodate this, the end of the extension 36 may be

fitted with a pick-up head 42 of a simple ring shape, with a seal 43 around the rim. In the case of some interfaces, a taper fit alone may be adequate, without the need for a soft seal.

In all cases the seal may be either a different material or the same material as the connector.

Optionally, the uppermost part of the tube 36 may be fitted with a flexible section to allow the pick-up head to mate properly with the sampling point even though the tube is not held entirely orthogonal to the sampling pipe. A flexible section 43 is shown in figure 4.

Other styles of sampling point may be accommodated by minor variations on the same general approach.

As the present invention may be embodied in several forms without departing from the spirit of the essential characteristics of the invention, it should be understood that the above described embodiments are not to limit the present invention unless otherwise specified, but rather should be construed broadly within the spirit and scope of the present invention as defined in the appended claims. Various modifications and equivalent arrangements are intended to be included within the spirit and scope of the present invention and appended claims.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS

1 Sampling point testing apparatus for testing a sampling point of an aspirated smoke detector system comprising:

a first portion adapted to sealingly engage a sampling point of an aspirated smoke detector;

a second portion comprising an air flow sensor operatively connected to an air flow data storage;

a third portion providing sealed fluid communication between the first and second portion such that air flows from the second portion into the sampling point via the first portion.

2. Apparatus as claimed in claim 1 wherein the second portion further comprises comparator means for comparing a measurement of the air flow sensor with a pre-recorded air flow measurement of the sampling point stored in the air flow data storage.

3. Apparatus as claimed in claim 1 or 2 wherein the air flow sensor is an ultrasonic sensor.

4. Apparatus as claimed in claim 1, 2 or 3 further comprising an articulated connection intermediate the first and third portions for providing relative movement between the first and third portions.

5. Apparatus as claimed in claim 4 wherein the articulated connection is a flexible collar.

6 A method of field testing an aspirated smoke detector system sampling point, the method comprising the steps of:

connecting a flow sensing apparatus to a sampling point of an air sampling system,

measuring the air flow rate into the hole,

comparing the measured airflow with the airflow previously measured at the time of commissioning

determining from the comparative measurements whether the air-sampling hole requires maintenance.

DATED this 24th day of September, 2003
VISION FIRE AND SECURITY PTY LTD
By DAVIES COLLISON CAVE
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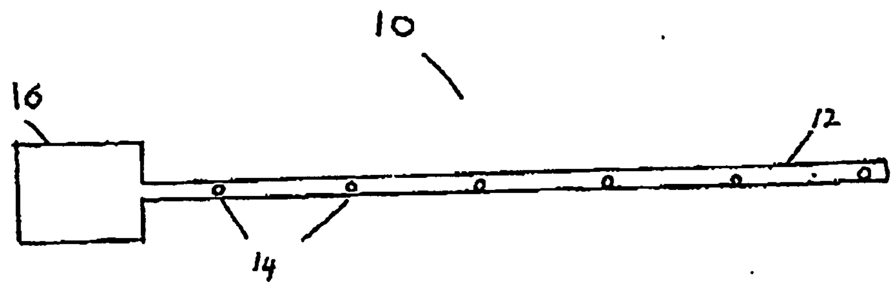


Figure 1

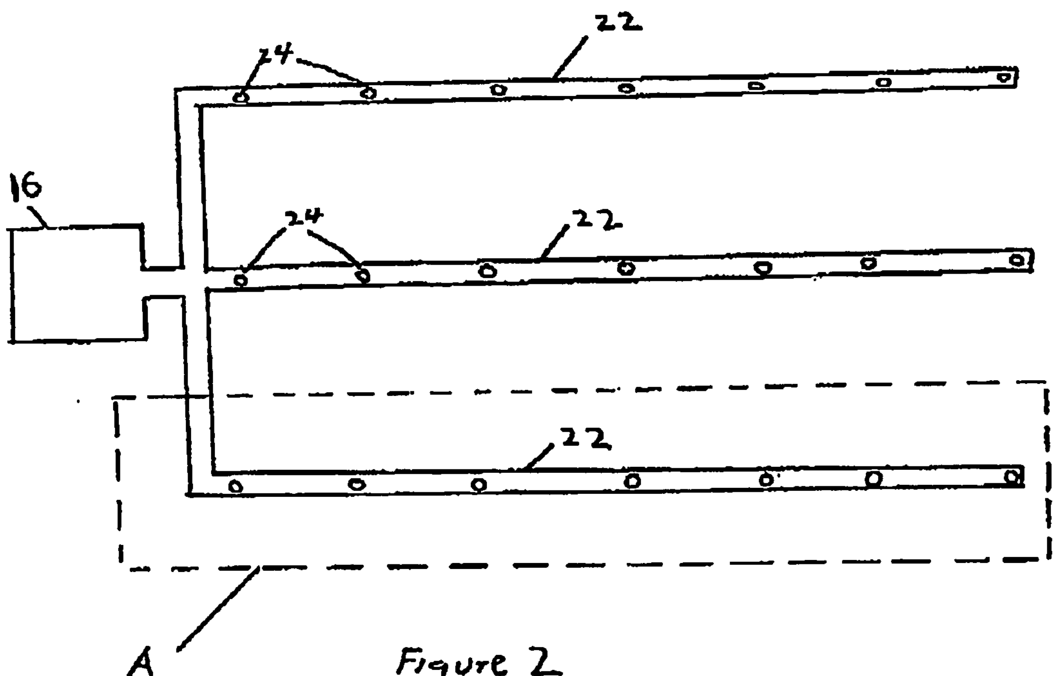


Figure 2

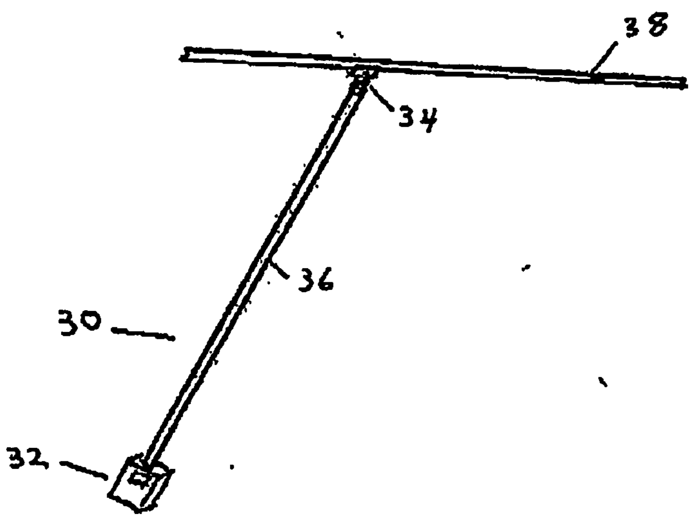
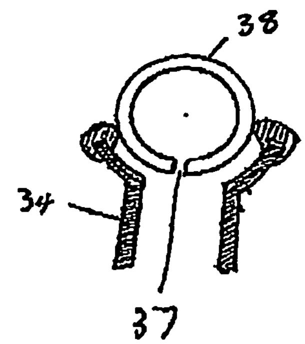


Figure 3

Figure 5a



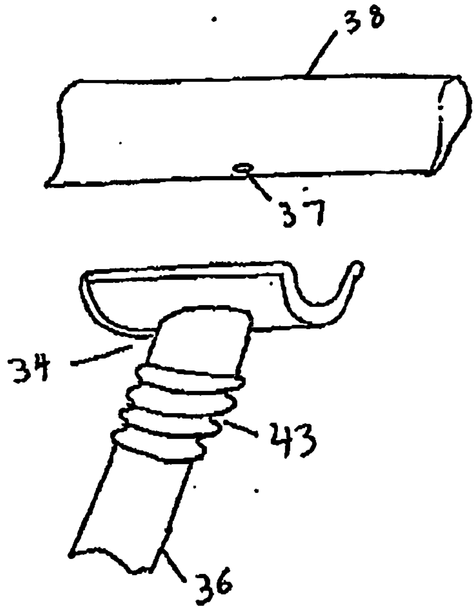


Figure 4

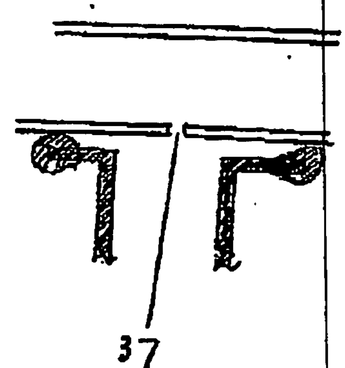


Figure 5b

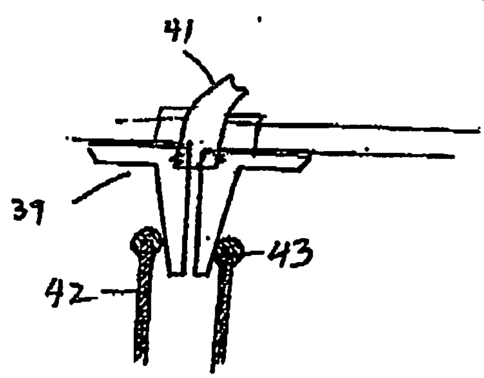


Figure 6